High Performance and Accurate Change Detection System for HyspIRI Missions, Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

We propose novel and high performance change detection algorithms to process HyspIRI data, which have been used for monitoring changes in vegetation, climate, coastal and ocean ecosystems, urban areas, etc. First, we propose a novel hybrid in-scene atmospheric correction (H-ISAC) algorithm, which can compensate for distortion of hyperspectral image characteristics due to atmosphere. Conventional ISAC is applicable only to imagers with wavelengths larger than 1 micro-meter and hence it is not applicable to HyspIRI imager which has a wavelength range of 0.38 to 2.5 micro-meters. Our algorithm is simple to implement and does not require any dark pixels in the images. Second, after images are atmospherically compensated for, we propose a novel change detection algorithm known as MRCD (multiple reference change detection) using multiple images collected in the past. Our algorithm can handle misregistration and parallax issues and hence the change detection results will be more accurate. Third, we propose high performance algorithms to determine the content of the changes. For example, what materials are in the changes and where these materials are distributed. We will also determine if there are any new and unseen materials in the changes. To determine known materials with known signatures in the changes, we propose a fast matched signature identification algorithm called Adaptive Subspace Detector (ASD). We compared ASD with several other tools and found that ASD outperformed other methods. To determine any anomalies, we propose a high performance anomaly detection tool called clustered kernel Reed-Xiaoli (CKRX) algorithm. This tool was recently developed by us, is fast, and can achieve very high anomaly detection rate in hyperspectral images from the Air Force. Fourth, the above tools can be implemented in a parallel processing architecture, in which the computations are distributed to multiple processing cores.

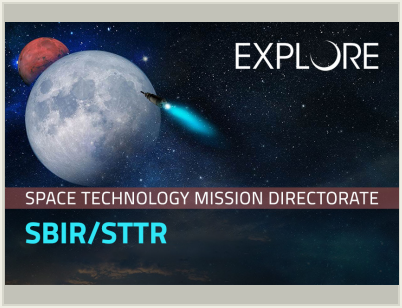

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Table of Contents

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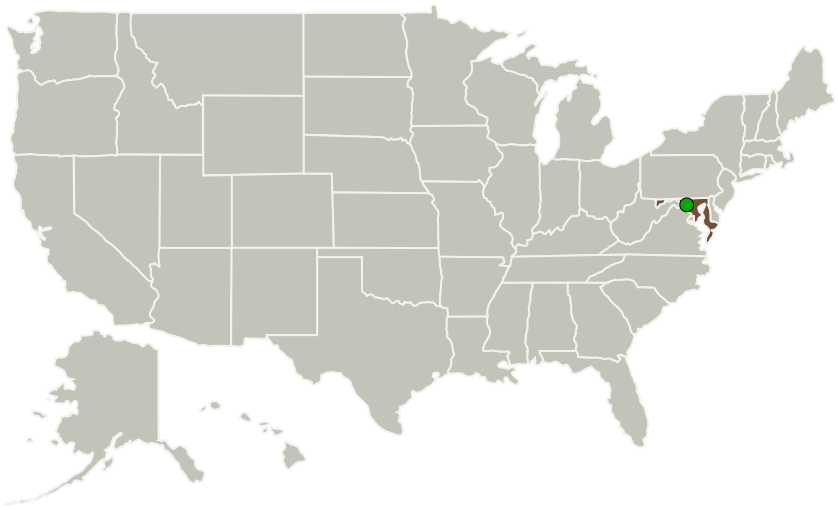
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Signal Processing, Inc.	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Rockville, Maryland
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

February 2012: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Signal Processing, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

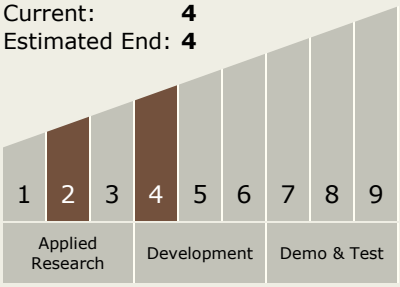
Carlos Torrez

Principal Investigator:

Chiman Kwan

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138207)*

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.1 Situational and Self Awareness
    - TX10.1.6 Anomaly Detection

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System